

An
Inaugural Dissertation
on the

Proper means for resuscitating the apparently dead
from drowning.

Submitted to the examination
of the
Trustees and Medical Professors
in the

University of Pennsylvania.

1813

Chambers's Repertory

on the

History of the

from the

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Gratitude.

With much diffidence I submit the following dissertation to your inspection. The subject it comprises is unquestionably an important one; and I have to regret, that both time and talents have been wanting to do it justice.

Of very many imperfections in the succeeding pages, I am fully conscious, nor can I doubt that there are many more which will not escape your superior discernment. Yet I feel some confidence in believing, what I have said will be regarded with that lenity and candour, which soon distinguishes the noble heart and enlighten'd mind. My highest expectations will be answered, if by your decision I am enabled to say

——— *Vilavi denique culparum*

Non laudandis manis.

In treating the subject of this dissertation I have previously to laying down the proper means for resuscitating the apparently dead from drowning, described the common effects of drowning; then briefly enquired how the cause acts in producing these effects, and afterwards, to throw some light on the indications of cure, taken a slight view of the nervous influence exerted on the lungs in respiration. My description of the common effects of drowning, is taken from Coleman; it agrees pretty generally with that given by all the writers on the subject, whose works I have had an opportunity of consulting.

Common effects of drowning.

As soon as an animal is immersed in water, air is expelled from its lungs and immediate attempts are made apparently with great difficulty, to inspire in which a small quantity of water is taken in. The animal betrays increasing uneasiness, again expels air and takes in water. The duration of this process

ceases from one minute to five, when the muscles of respiration cease to act and all struggling is at an end. Some involuntary motions, however, generally succeed. On opening the chest, we find the two vena cava, eight sinus venosus, auricle, ventricle and pulmonary artery loaded with blood; the left auricle nearly distended with blood, the left ventricle about half the aorta and its branches containing a quantity of blood, which in all its appearances resembles venous. The lungs are found in a state of collapse, containing a small quantity of water, in the form of foam, but very trifling when compared to the quantity of air expelled from the lungs during the act of drowning. The stomach, on examination presents also a little water, which probably passed into the oesophagus when the rimæ glottidis was closed by the epiglottis; for as the water contained in the mouth is then refused admittance into the trachea, it should seem, that at that moment, it makes its way into the stomach; so that, as soon as the animal attempts to respire, water enters the trachea; but this organ, as if conscious of not receiving its due element, rejects the water, which is then allowed to pass into the oesophagus. Air is again emitted, and new efforts made to inspire, when upon the same sensation being produced, similar efforts arise; and after the last expiration, no more water enters the lungs or stomach.

Doctor Oswald thinks the water does not enter the lungs, in drowning, during the efforts made to inspire, but after they have ceased, and indeed his experiments go far towards a confirmation of this opinion.

Coleman continues "The heart has frequently been observed to contract, or more properly to vibrate for more than two hours after respiration was suspended, and that from no other stimulus, but its own blood, while in other experiments the vibrations did not continue one tenth part of that time. The right side of the heart preserves its action much longer than the left, and the auricles much longer than their corresponding ventricles."

"The peristaltic motion of the intestines does not continue as long as the con-

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contractions of the heart, and on opening the head, the veins as in ordinary death are found rather distended, but without the least appearance of extravasations."

I shall now briefly enquire how the water acts in producing the effects just described. Does it act directly by entering the cavity of the lungs, or indirectly by excluding air from them? That a portion of water does enter the lungs of an animal when submerged, either during its efforts to inspire, or very soon after those efforts have ceased, is a fact well established; but that the quantity of water thus taken in, is insufficient to destroy life, I think, is very satisfactorily proved by a set of experiments instituted by Baron Cuvier, for the purpose of ascertaining the fact. He first very ingeniously ascertained the quantity of fluid taken into the lungs in drowning, by confining animals submerged in Mercury, until they ceased to exhibit signs of life; it was then easy, after removing them, to determine the precise quantity of this fluid in the lungs, as the Quicksilver remained unmixed with the fluid contained in them in a healthy state; a circumstance which gives Mercury the preference to every other fluid in making these experiments. After having ascertained the quantity of fluid taken into the lungs in drowning, the Doctor, in order to discover whether that alone was sufficient to produce death, injected a quantity of water equal to the sum of the fluids (the Mercury and natural mucus of the lungs) found in the lungs of the drowned animals, through an opening made in the trachea of other animals which were in a healthy state. This produced no other symptom than a difficulty of breathing and a feeble pulse; both of which were soon abated and the animals lived several hours afterwards without much apparent inconvenience, when they were strangled.*

Thus it appears that, the water which enters the lungs of an animal after submersion is not sufficient to produce the changes which

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take place in drowning, and that these changes must be occasioned indirectly by the exclusion of air from the lungs.

I shall not enquire into the particular effects, either chemical or mechanical, which the air exerts on the lungs in respiration. The most type in Physiology is well acquainted with the fact that inspiration and of course life, cannot be supported without oxygen. Excluded an animal, by any means, from this vital pabulum, and death sooner or later will be the inevitable consequence. Whether oxygen gives irritability to the system, whether it is absorbed into the blood for other purposes; or whether it acts by decarbonating the venous blood, which it mingles with in the lungs without being absorbed at all, I shall not attempt to determine. For my purpose it is sufficient to know, that without it life cannot be continued. A knowledge of this fact leads to one of the most important indications for resuscitating the apparently dead from drowning, of the proper treatment of whom I am presently to speak. But in order that air may perform its proper office in the lungs, whatever that may be, it is necessary the influence of the nerves on those organs be duly exerted.

That respiration in a healthy state is under the influence of the nerves distributed to the lungs; under that of the brain when the many an desire, is I think, clearly demonstrated by some very interesting experiments of Mr. Dupuytren. This gentleman divided the eighth pair of nerves in a number of horses and dogs and found this division always mortal: compression of the nerves if continued any time, produced the same effect, it was even more speedily fatal. — The animals submitted to these experiments, exhibited all the appearances of asphyxia produced by a non respirable, but not deleterious gas; the blood in the arteries and veins becoming of a coal black.

Death appeared to take place in these cases, on consequence of the action of the lungs being suspended and not from the suspension

* See a paper read by M. Bugey, chief of the anatomical department
in the medical school of Paris &c. - translated for & published in
Edinburgh Repository, Vol. 1. Number III.

the action of the chest & of the heart; as whilst the animal is in the
state of life the blood is circulated through the
arteries & the veins was used and so regulated as to be alternately con-
verted into food & the animal could be made to pass from life to oppo-
site state of life. Thus the power of the pulse is a power of passing from
life to death & that this influence may be easily determined to be large
in one case & to be small in the opposite case for a given case, is
easily observed.

Various diagnostic marks have been laid down
by writers, to distinguish the disease brought on by submission from above
and put it into a species of morbus caducus by the
more or less violent and the more fatal consequences. I have
into this, with Calaneo, that it is not so better to have
a large of the disease of life, as to have a small one
in any case, the latter is more dangerous and for
prognosis.

I point now to the indications of curative and the best
means of fulfilling them. They are,
1st to restore the blood its natural and healthy quality and put it
downing the by restoring to it the necessary influence of oxygen.
2nd to restore the circulation in order that the blood may be brought
back to the life of the animal indispensable to the animal economy.
The first of these indications is fulfilled by calling the lungs on
the action of the lungs, the second by stimulating the heart and blood vessels
The means for the recovery of the animal is to be found in the
lungs & the heart, the most looking for the lungs
the heart & the blood vessels. The first of these is the lungs
the heart & the blood vessels. The first of these is the lungs

* Various modes of applying Heat have been recommended, &c. &c.
The warm bath, covering the patient with heated sand &c.
these in general take up too much time in their preparation
- tend too frequently to the debilitation of the patient.



* The whole of the first of October was a day of
the most beautiful weather, a fine wind, & a
clear sky, the sun shone brightly the temperature
by the end of the day was 60°.

Ed. Johnson in California

the lungs as follows: 1. In some cases, the lungs are found to be inflamed, and in such cases, the sound measured be produced.

It is unable to inflate the lungs in any of the above cases, and a closure of the vessels, from a spasm of its muscles, the closure of the trachea, should be immediately performed, and the lungs inflated by the Spontaneous or the wind pipe. At the same time, the galvanic shocks should be passed alternately between the head and the feet, in order to promote the nervous influence to the lungs. It is also known from experiments that in France that the galvanic fluid flows through the nerves of the lungs.

The galvanic fluid is one of the most powerful agents in exciting the nervous system and producing contraction. It is reasonable to expect great advantages from its use in those cases of apnoea, in which the vital force is nearly exhausted. Fortunately in most cases of suspended animation, the system recovers a considerable degree of vitality. It is necessary, however, to be careful in its application. The use of the galvanic fluid should never be omitted, when the apparatus necessary for its application can be obtained. Animals which were apparently dead have been restored by its influence alone.*

It has been supposed by some that the heart is not susceptible of the galvanic influence; but we have seen several instances in which it has been restored by its influence. It is also known that the heart of Asclepias, Vesali, and others, has been restored by its influence.

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* notes on and Johnson's inaugural dissertation

what is not a part of the system. These are certain strong stimuli
thrown into the body, fictitious and particular stimuli applied to the nose
and ears.

The stomach is the seat of sympathy with the nervous
system, and as impressions made upon it are so rapidly propagated
to all the other parts, much service may be expected from the introduction
of remedies into it. There should be a safe route as to and from the
and powerfully, as other, Volatile Alkali and Acids. Spirit of
Calle or their articles will be found to answer the purpose as well as
and it has the advantage of being generally at hand. These remedies
be very conveniently injected into the stomach by means of a syringe
which is to be introduced into the nostril. If the
of this kind be not at hand, they may be readily, however, obtained
from a vessel with a short tin patients hand being a little elevated. The
should be warmed before being passed into the stomach. These remedies
in many cases will be sufficient to inject at once; if the patient
objects to this of inconvenience the quantity may be increased. If
applied to the system, it would produce a
of the system to be dissolved in it. The efficacy of the
to these introductions, the water
the stomach is to be injected by means of a syringe.

If the stomach should be thrown up, the
should consist of some warm aromatic. There should not be too much
so as much to distend the lungs, which would be injurious by forcing
easy descent of the diaphragm. Hence the impropriety of using
emetics. It has been suggested by a writer on this subject that so
as to get the contents into the intestines, might do good by opening
the bowels.



It is a great good might result from the employment of these would
be more than counterbalanced by their mechanical harm. I need say nothing of
the injury to the diaphragm & the lungs in this case as well as the
nervous system to be ever judicious practitioners. For an account of the de-
lirious effects of this article when used in cases of suspension an
refer the reader to the inaugural dissertation of Dr. L. L. L.

Functious are of great importance and should not be neglected
they assist in promoting the blood through the lungs & vessels and at the
same time stimulate the nerves of the skin. One method of treating
the sweat out or any more grease will answer the purpose but
well. When a mild substance of this kind is used the patient
long continues without fear of excoriation. It is a common
common attention, as the use of it does not cause any great
will be promoted when acid substances are employed.

Stomatology applies to the nose, by its connection with the
mouth & its relation to the diaphragm and lungs.
The sense of hearing has been said to remain longer in some cases
of a later time. This power seems to be more preserved in
the old than in the young and is the last to be lost. It is
involuntary, and is not under the control of the will. It is
the last sense to be lost in the brain, for the sense of sight is the first.
It is a common mistake to suppose that the sense of hearing is
number of years of living & dying, and is the last to be lost
from the body. It is a common mistake to suppose that the
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begin to return, we should relax our operations and proceed with the utmost circumspection. By overruling our part at this critical juncture, we might lose one of the highest pleasures attending the exercise of our profession, and have the severe mortification of seeing our patient perish, at the very moment we began to fancy our endeavours crowned with success. I cannot better express the line of practice we are to pursue, in the momentous stage of our patients recovery, just alluded to, than in the words of Dr Armstrong.

While the vital fire
Burns feeble, heap not the green fuel on;
But prudently foment the evanescent spark
With what the soonest feels false dissipated touch.
Be frugal even of that; a little gives gain
At first; that kindles, add a little more;
Till by delicate nourishing the flame
Keen'd, with all its wonted vigor glows.

The precise time at which our attempts to restore the unfortunate objects of our attention, should cease, cannot well be laid down; no general rule should be continued at least four hours - Whilst there is yet reason to believe the faintest spark of life remains, we should not despair of being able to fan it into perfect animation. Nothing should induce us to omit our endeavours, whilst the remotest possibility, of preventing a fellow creature from being prematurely banished into eternity, remains. Do we fail? we have the consoling reflection of having done all, that duty and humanity requires - Are we successful - our reward more than equals every exertion. Who would not rejoice at bringing back to life and repentance, the poor wretch,

who has prayed to put an end to the horrors of guilt, or despair, by
a watery grave — When the bosom that resists not throbs with plea-
sure next to divine, at being the instrument of restoring to helpless
and dependant family their comfort and support; by snatching from
the very dominions of death, the kind husband and affectionate father.

To we respect the duty of man to man and of man to his God —
as we judge the feelings of a self approving conscience, we will perse-
vere in our attempts to resuscitate the apparently dead from despon-
ding —

and the first of the two is the most important
and the second is the most important
and the third is the most important
and the fourth is the most important
and the fifth is the most important
and the sixth is the most important
and the seventh is the most important
and the eighth is the most important
and the ninth is the most important
and the tenth is the most important